A STABILIZED/MULTISCALE FINITE ELEMENT METHOD FOR SUPER-ELASTICITY IN SHAPE MEMORY ALLOYS

Arif Masud and **Kaiming Xia**

Department of Civil & Materials Engineering
The University of Illinois at Chicago
Chicago, Illinois 60607-7023
Ph (312) 996-4887; Fax (312) 996-2426
amasud@uic.edu

This paper presents a multiscale variational method for developing stabilized finite element formulations for application in nonlinear solid mechanics. The multiscale method arises from a decomposition of the displacement field into coarse (resolved) and fine (unresolved) scales. The resulting finite element formulation allows arbitrary combinations of interpolation functions for the displacement and stress fields, and thus yields a family of stable and convergent elements. Specifically, equal order interpolations that are easy to implement but violate the celebrated B-B condition, become stable and convergent. A nonlinear constitutive model for the superelastic behavior of shape memory alloys is integrated in this multiscale variational framework. Numerical tests of the performance of the elements are presented and representative simulations of the shape memory behavior are shown.

Reference

1. A. Masud and K. Xia, "A New Mixed Multiscale Finite Element Method for Nearly Incompressible Elasticity", to appear in *International Journal for Numerical Methods in Engineering.*